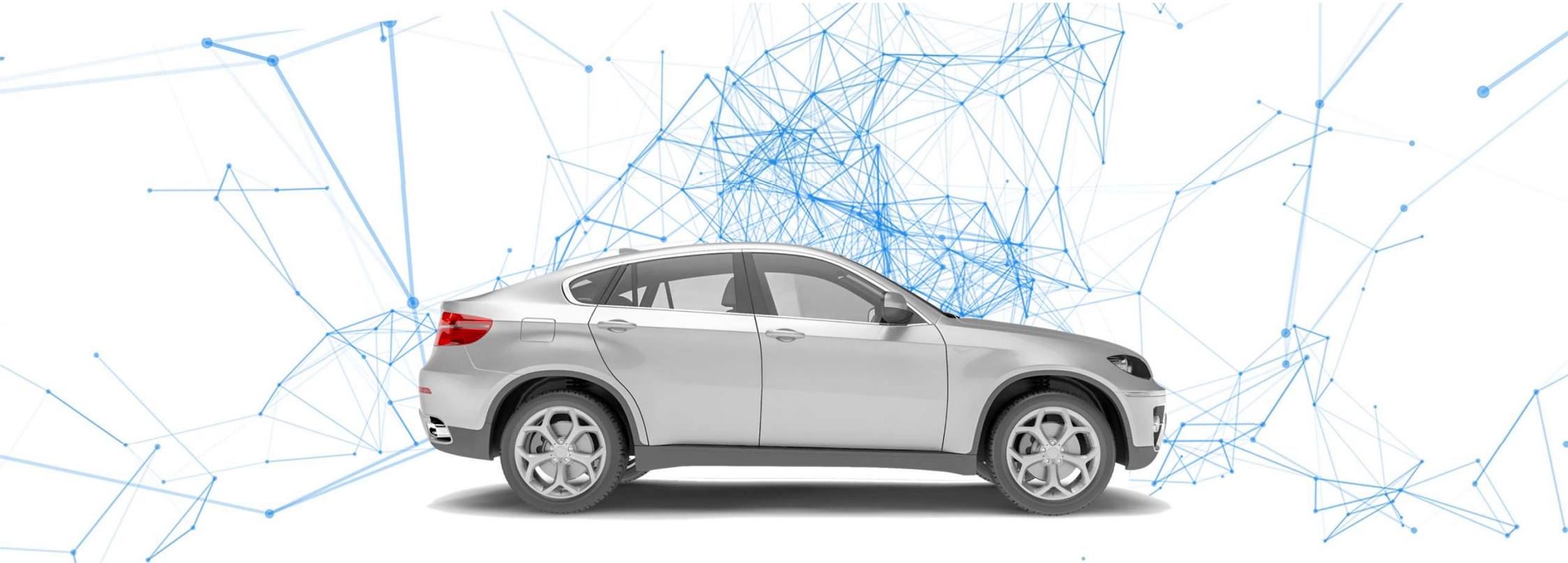


ETHERNOVIA

TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1DG – TDMA MODES | 2021-05-11

ADDITIONAL AFFILIATIONS: BMW, RUETZ SYSTEM SOLUTIONS

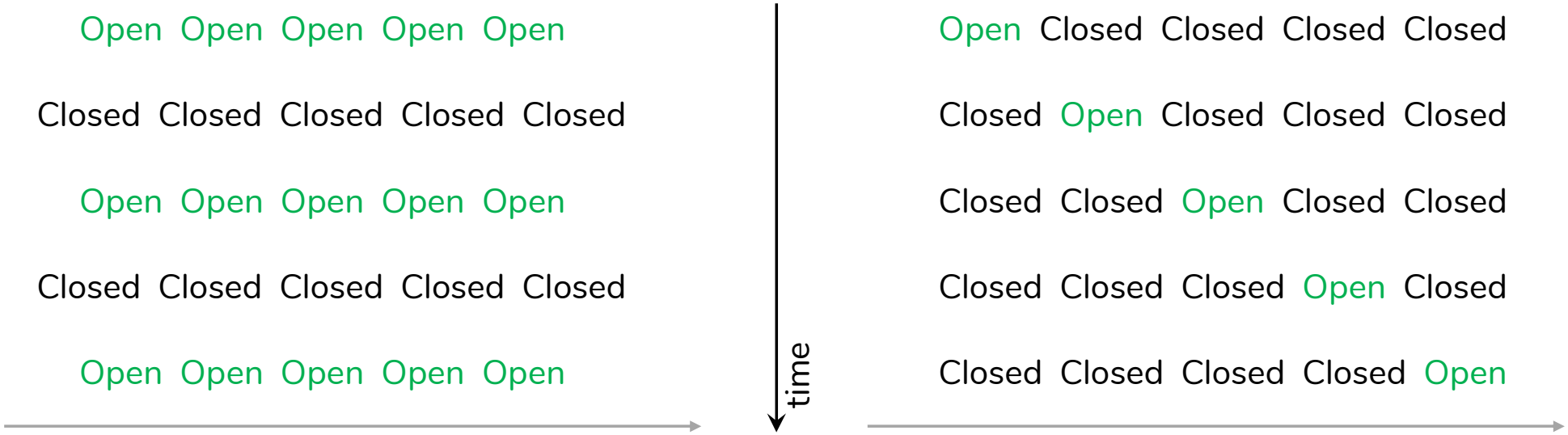
IEEE contribution

ETHERNOVIA
TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1Q-2018 8.6.9.1.1 SetCycleStartTime()

Slide 4 from 2021-04-20

NOTE 1—Since the origin of the PTP timescale is 1 January 1970 00:00:00 TAI, CycleStartTime will be larger than 1.3×10^{18} ns. If sufficient precision is not maintained when computing N, CycleStartTime will not be an integer multiple of OperCycleTime, which could result in misalignment of the cycles at ports on different bridges.

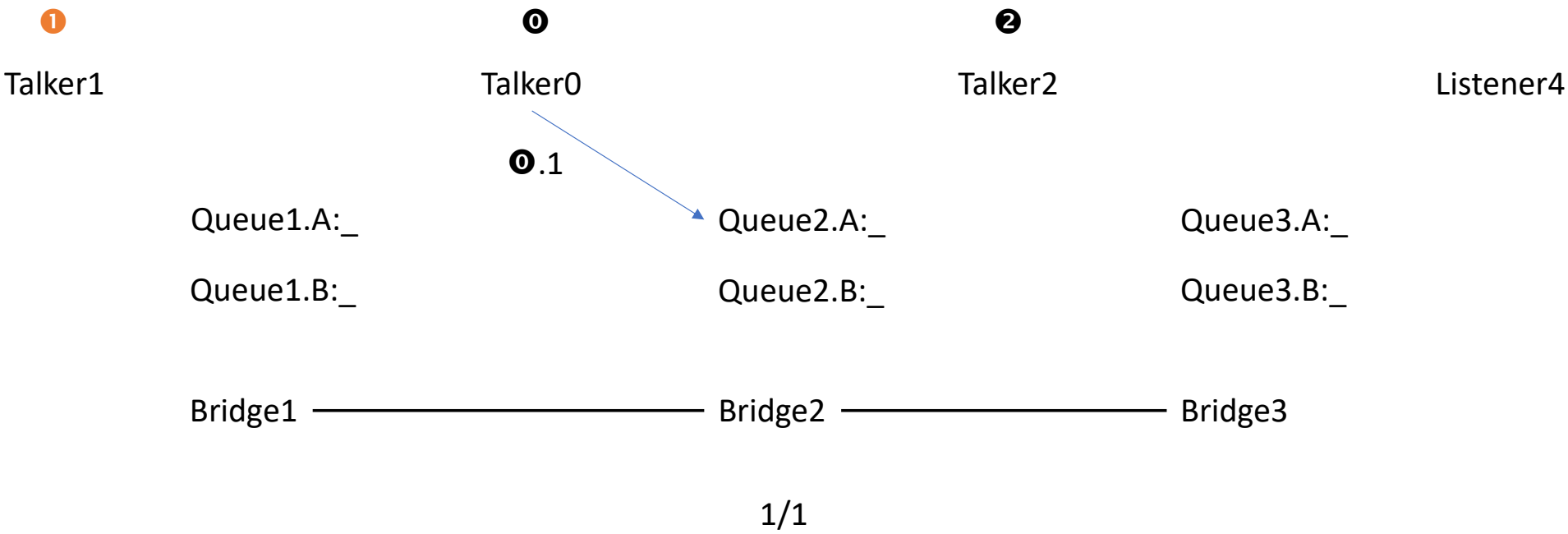


Looking at the one Gate a specified Frame will encounter through the network.

A very simple network model

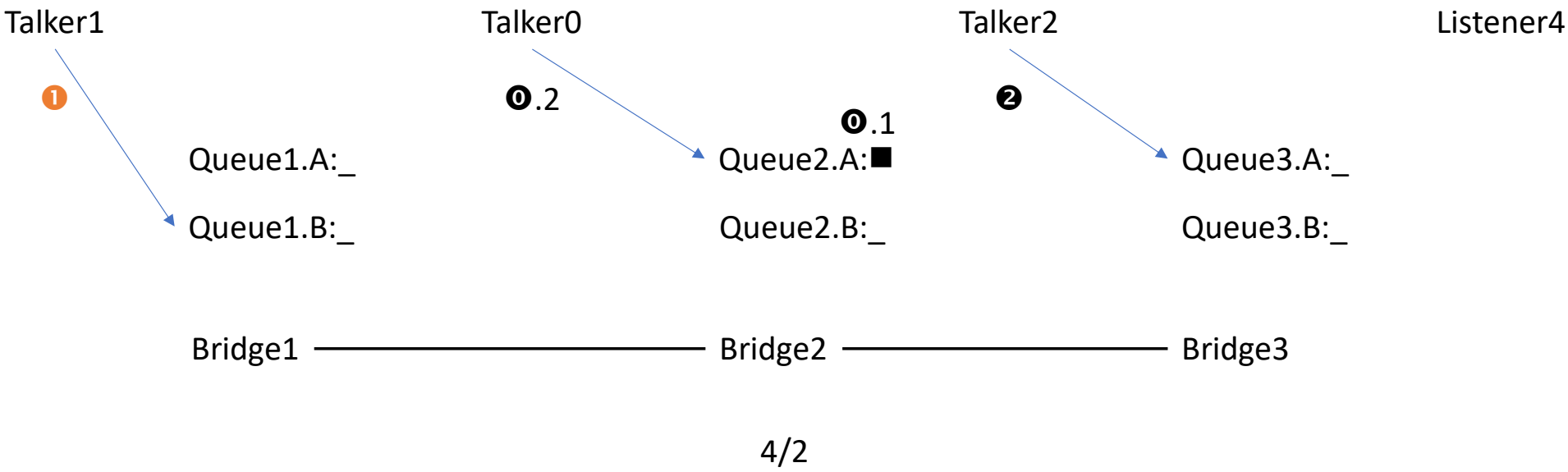
Starting without any TDMA

No TDMA enabled
TimeIndex: N000



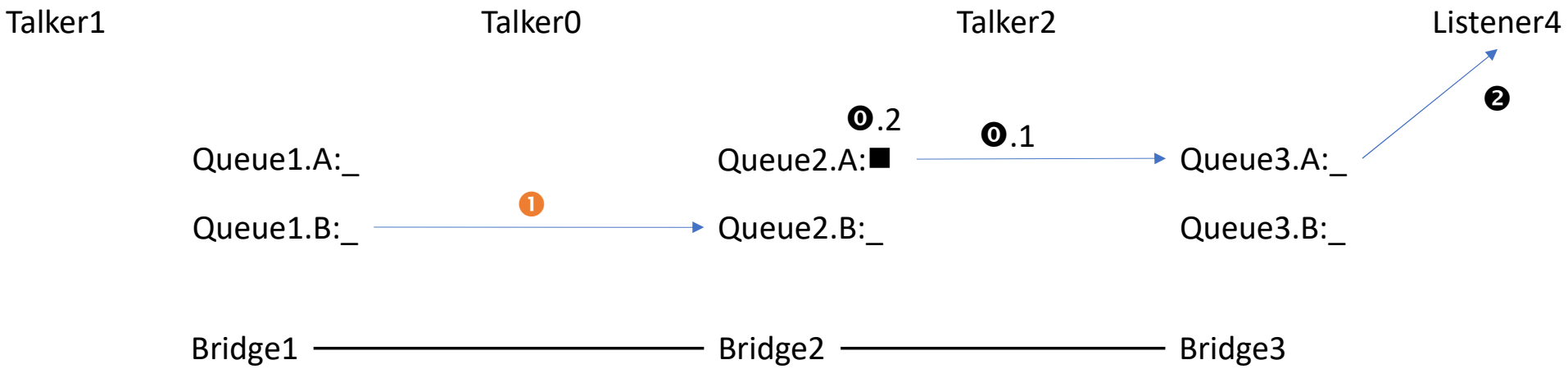
1/1

No TDMA enabled
TimeIndex: N001



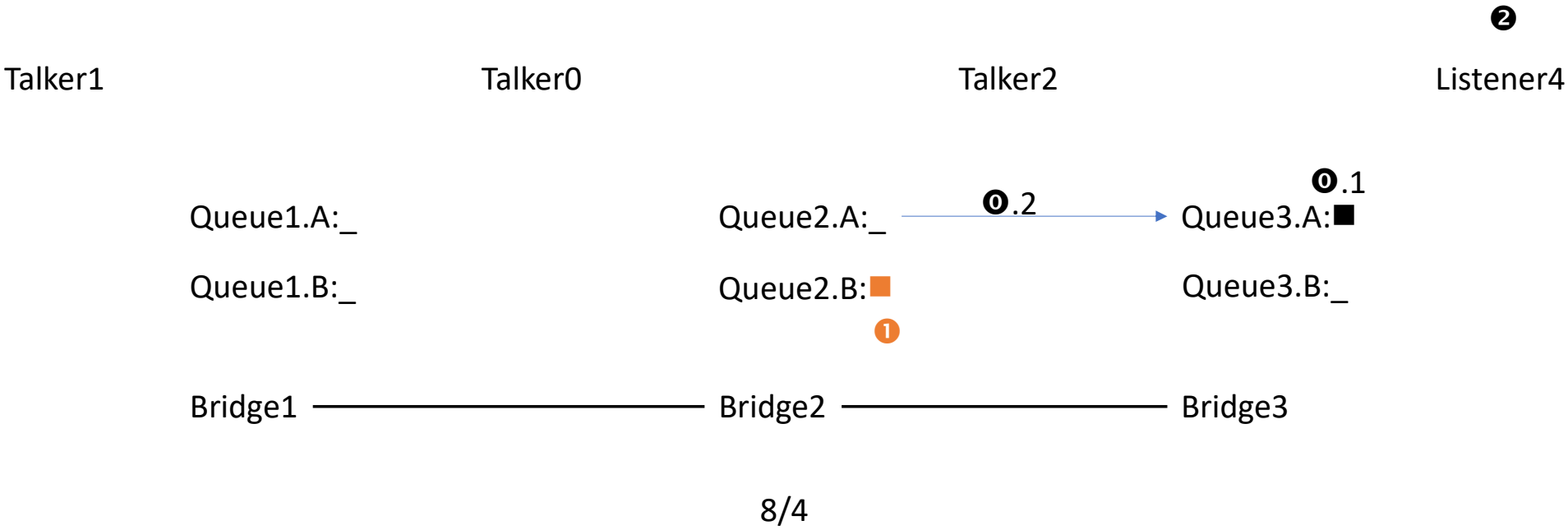
4/2

No TDMA enabled
TimeIndex: N002



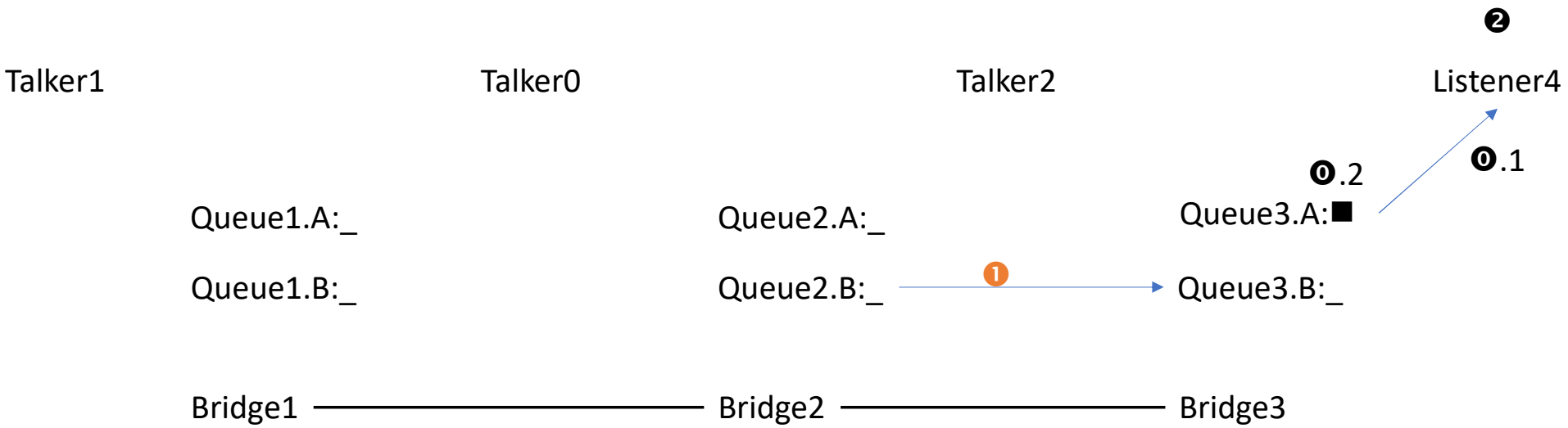
7/3

No TDMA enabled
TimeIndex: N003



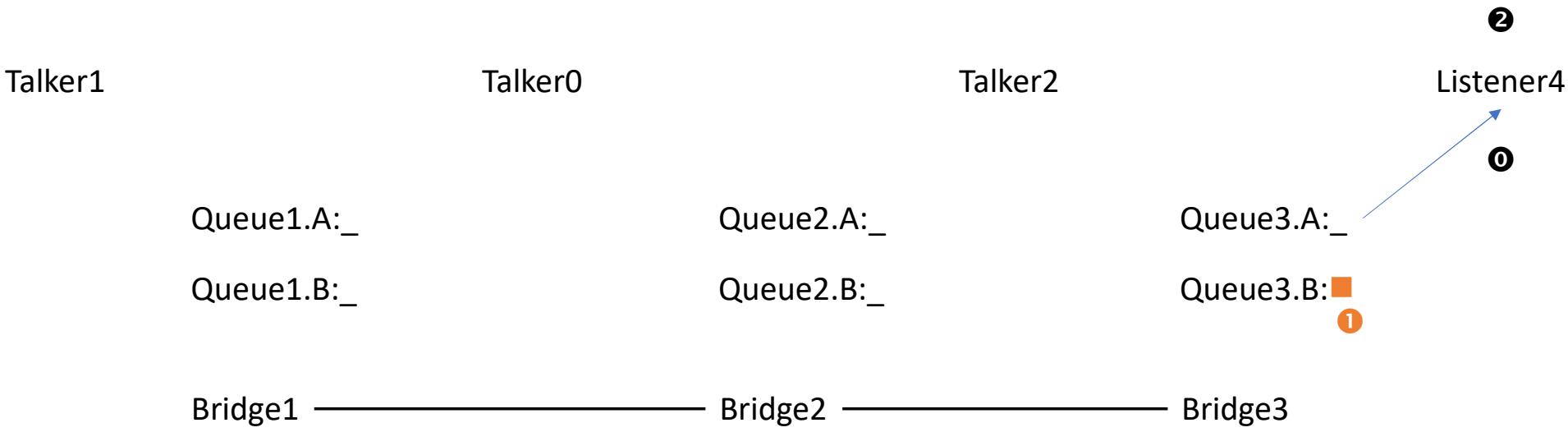
8/4

No TDMA enabled
TimeIndex: N004



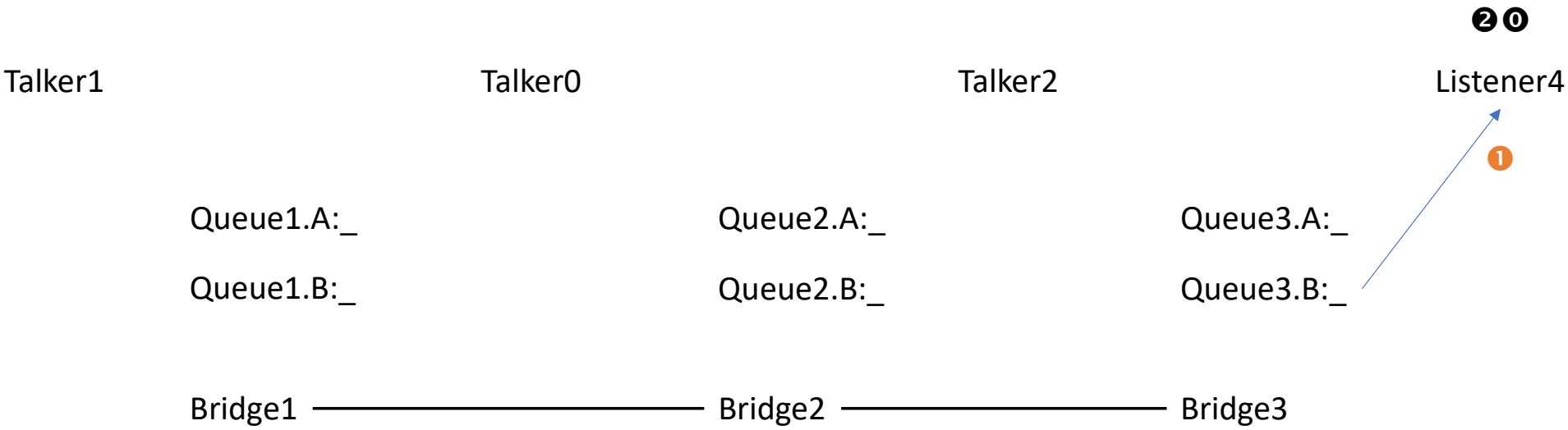
10/5

No TDMA enabled
TimeIndex: N005



11/6

No TDMA enabled
TimeIndex: N006



12/7

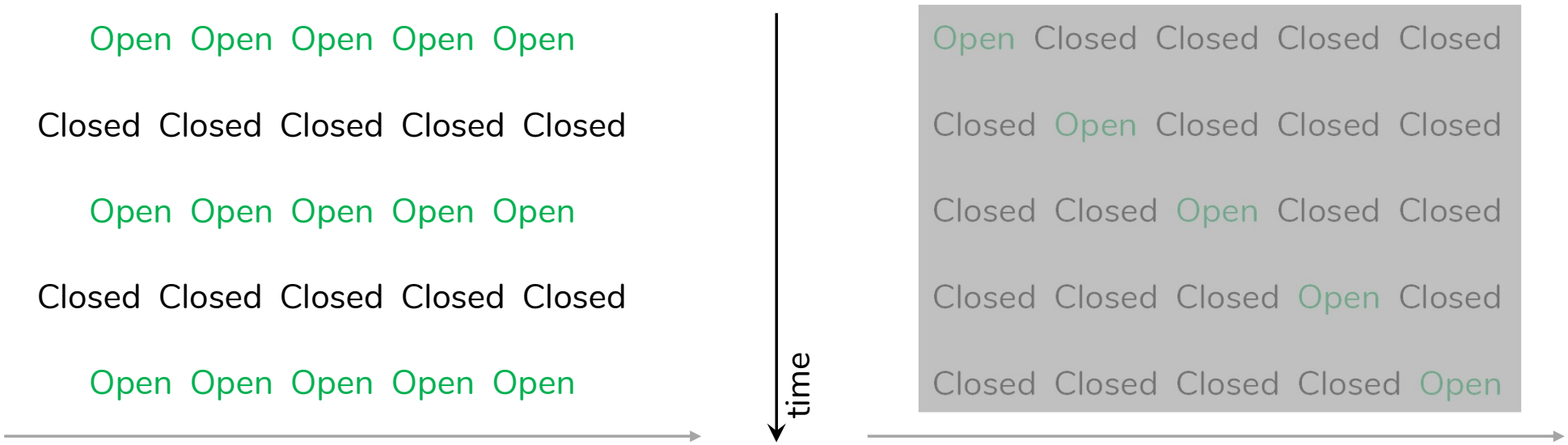
Bus-Mode TDMA

The FlexRay timing model on switched Ethernet

IEEE802.1Q-2018
8.6.9.1.1 SetCycleStartTime()

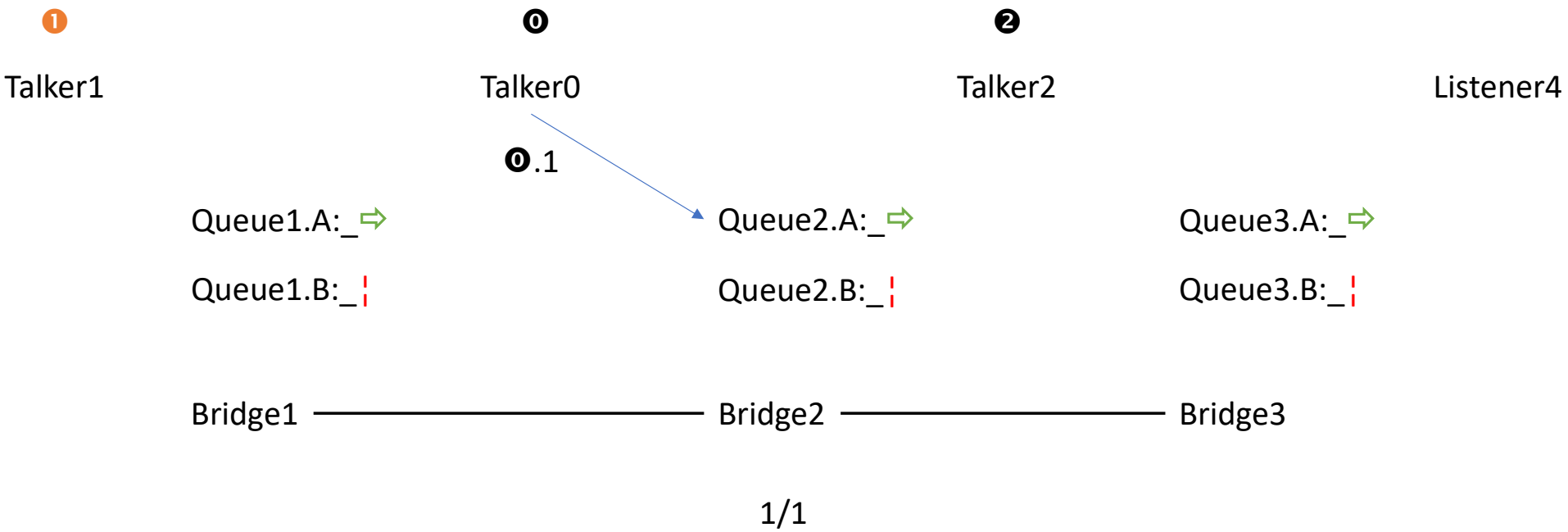
NOTE 1—Since the origin of the PTP timescale is 1 January 1970 00:00:00 TAI, CycleStartTime will be larger than 1.3×10^{18} ns. If sufficient precision is not maintained when computing N, CycleStartTime will not be an integer multiple of OperCycleTime, which could result in misalignment of the cycles at ports on different bridges.

Bus-Mode TDMA



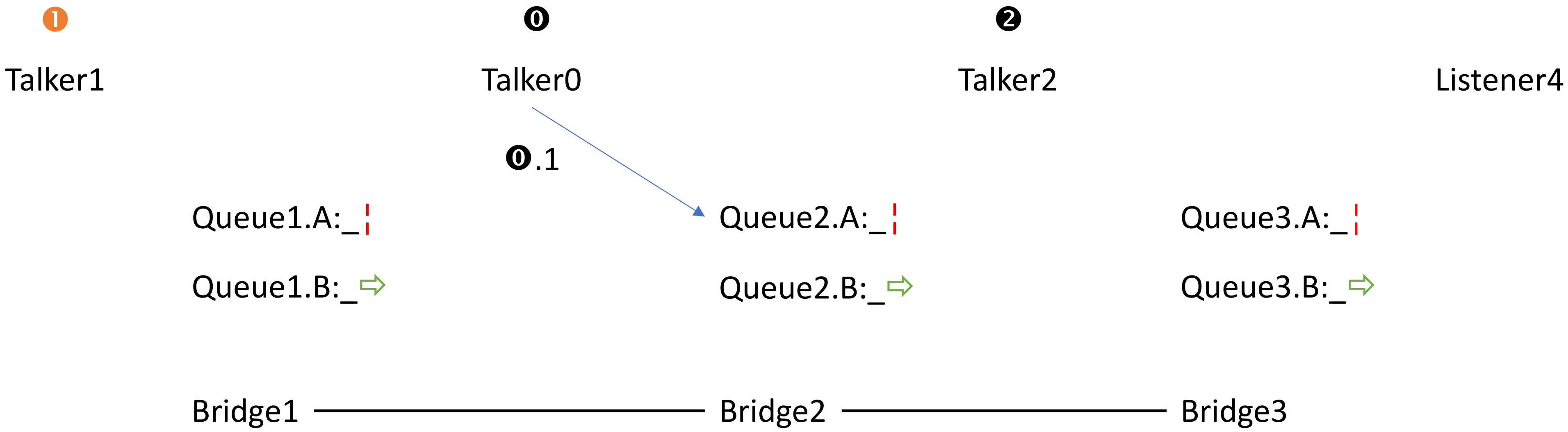
Looking at the one Gate a specified Frame will encounter through the network.

Bus-Mode TDMA enabled TimeIndex: B000

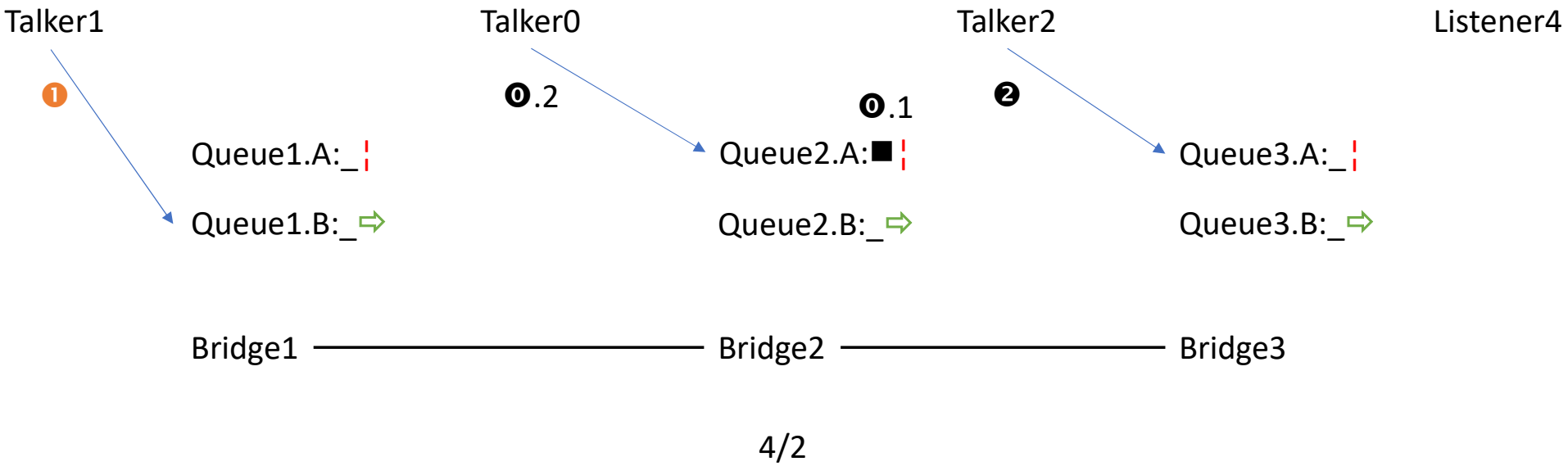


Bus-Mode TDMA enabled TimeIndex: B000.5

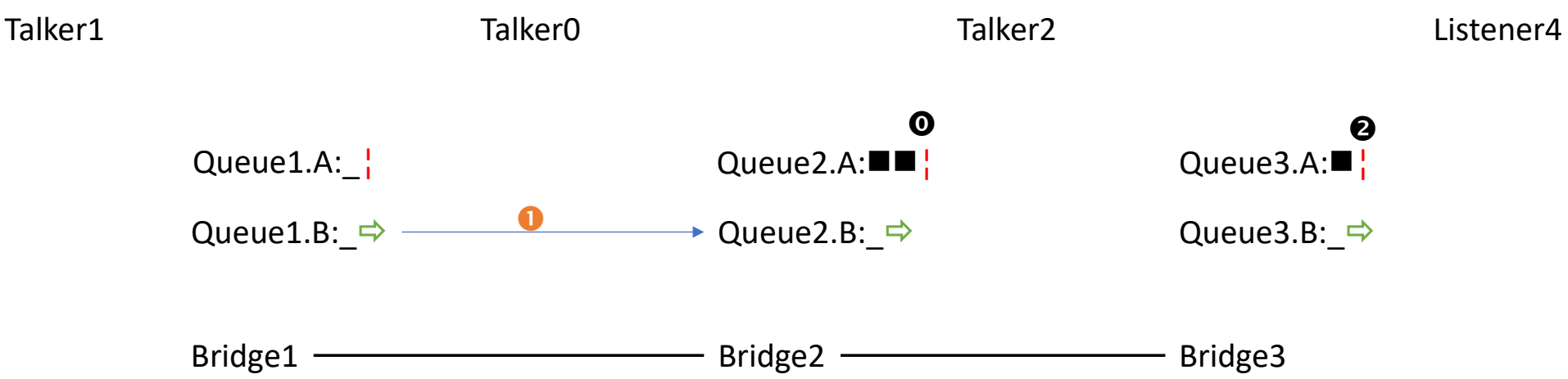
System-Wide Guard-Band Queue#.A Start!



Bus-Mode TDMA enabled
TimeIndex: B001

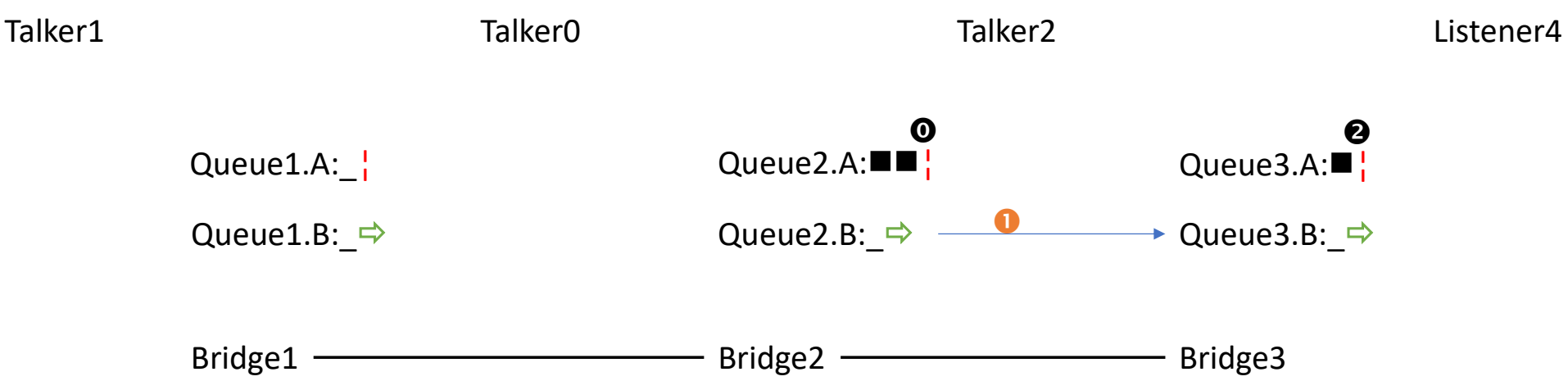


Bus-Mode TDMA enabled TimeIndex: B003



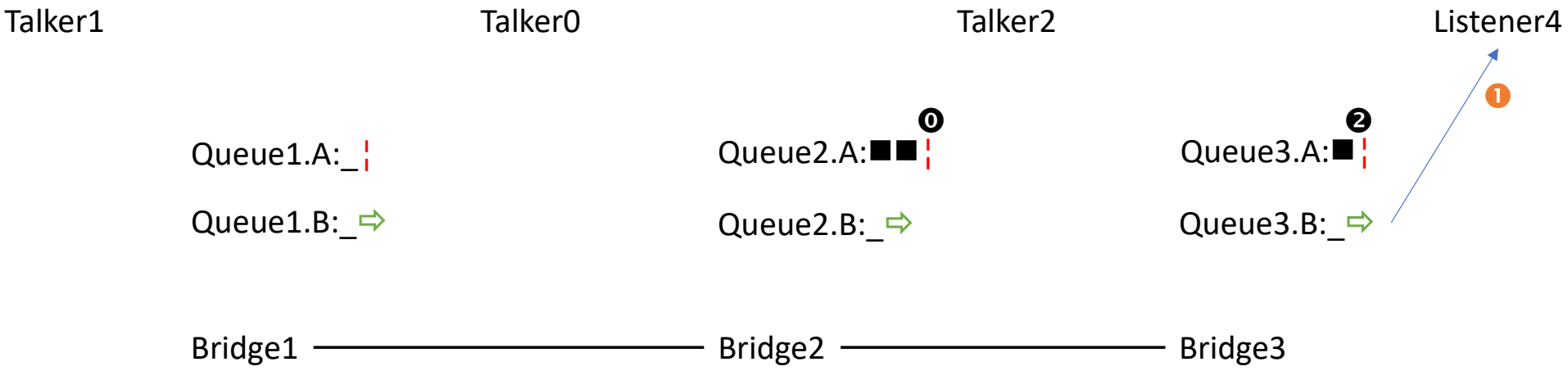
5/3

Bus-Mode TDMA enabled
TimeIndex: B004



6/4

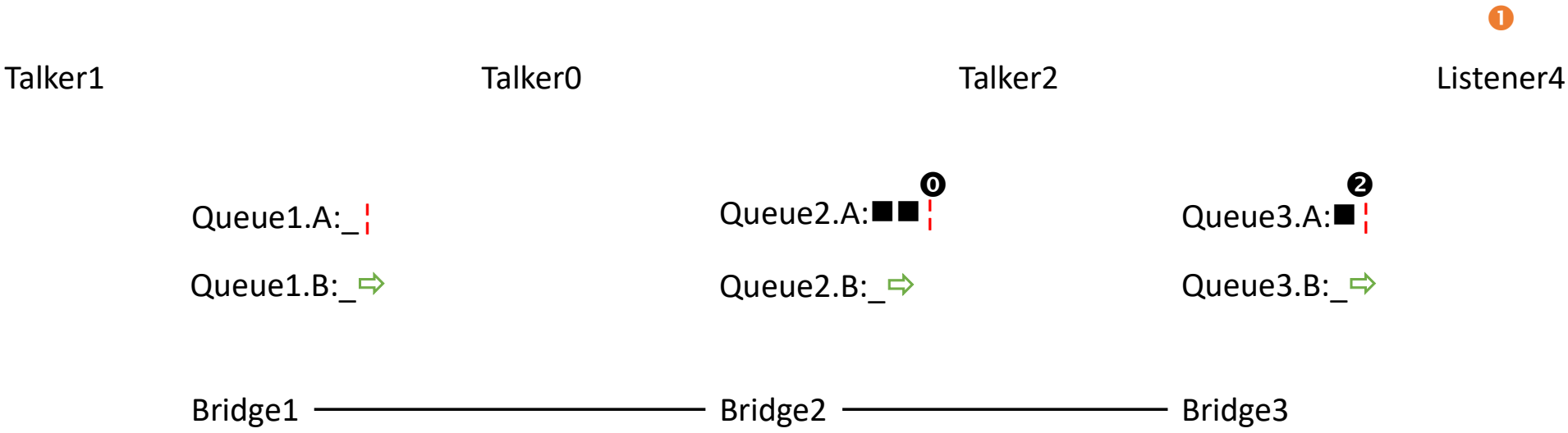
Bus-Mode TDMA enabled TimeIndex: B005



7/5

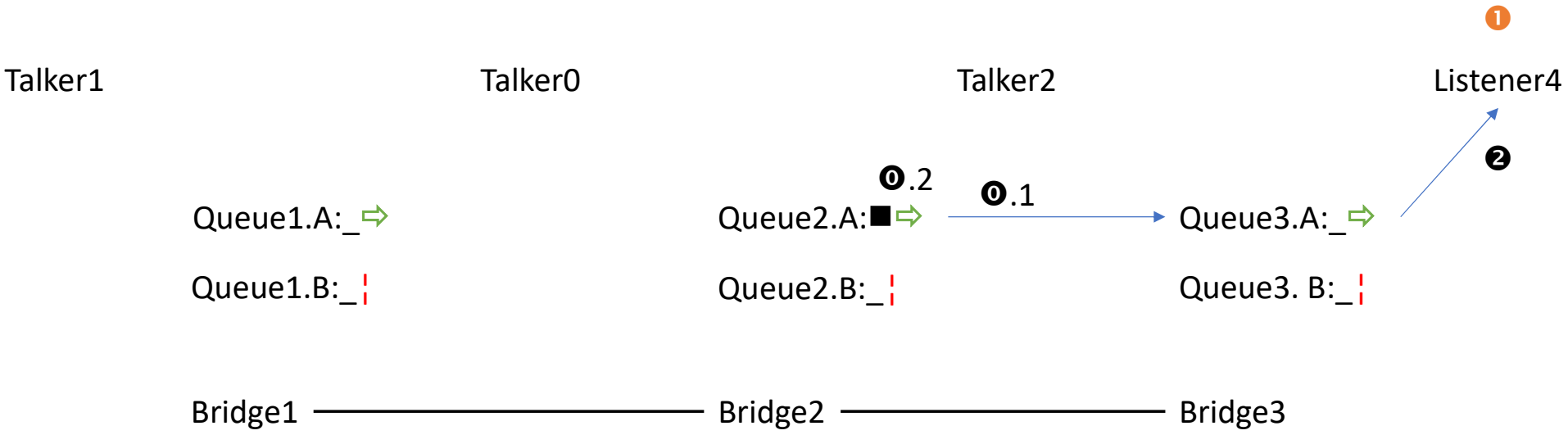
Bus-Mode TDMA enabled TimeIndex: B005.5

Tolerance Band



Bus-Mode TDMA enabled TimeIndex: B006

All Queue#.A open back up.



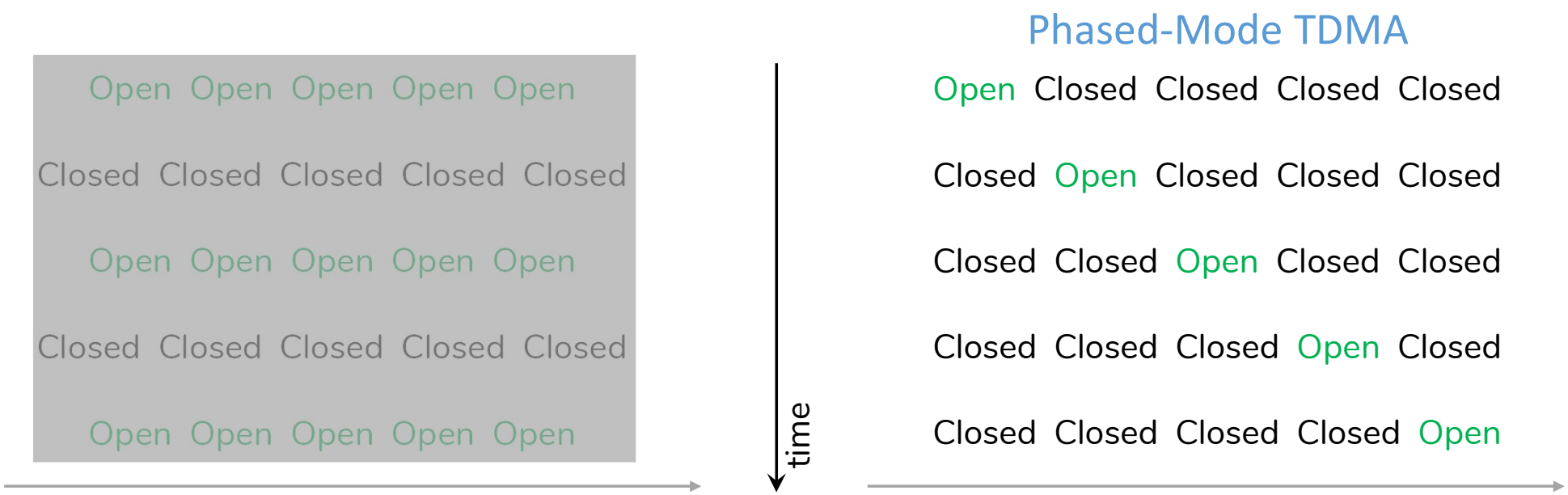
9/6

Phased-Mode TDMA

"La Ola the wave" on switched Ethernet

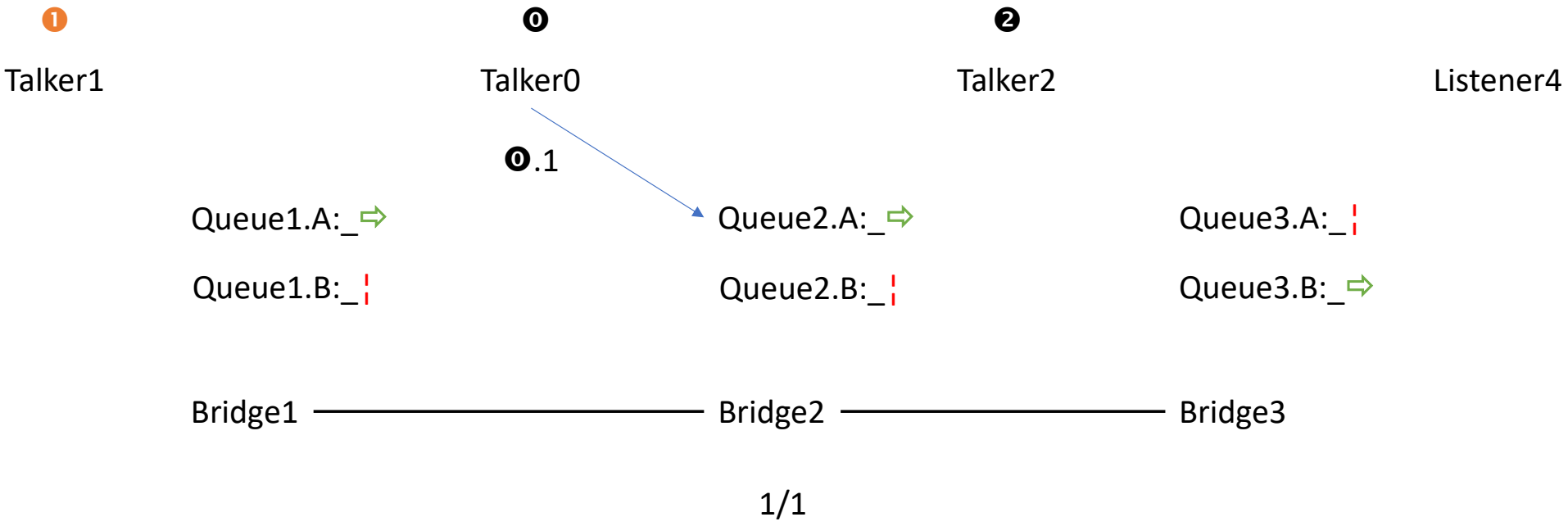
IEEE802.1Q-2018
8.6.9.1.1 SetCycleStartTime()

NOTE 1—Since the origin of the PTP timescale is 1 January 1970 00:00:00 TAI, CycleStartTime will be larger than 1.3×10^{18} ns. If sufficient precision is not maintained when computing N, CycleStartTime will not be an integer multiple of OperCycleTime, which could result in misalignment of the cycles at ports on different bridges.



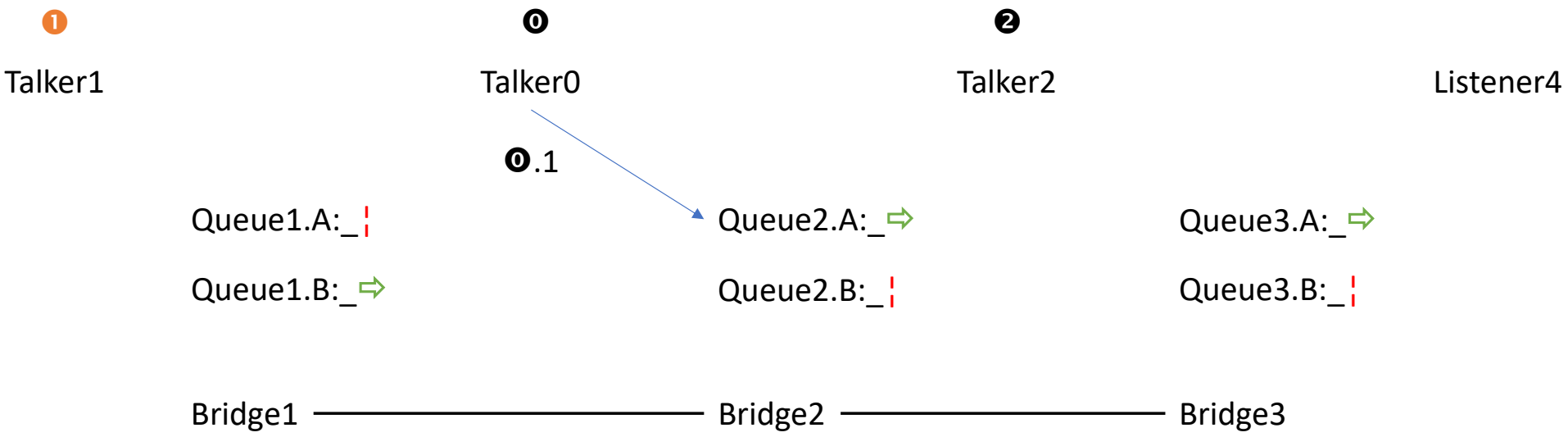
Looking at the one Gate a specified Frame will encounter through the network.

Phased-Mode TDMA enabled TimeIndex: P000



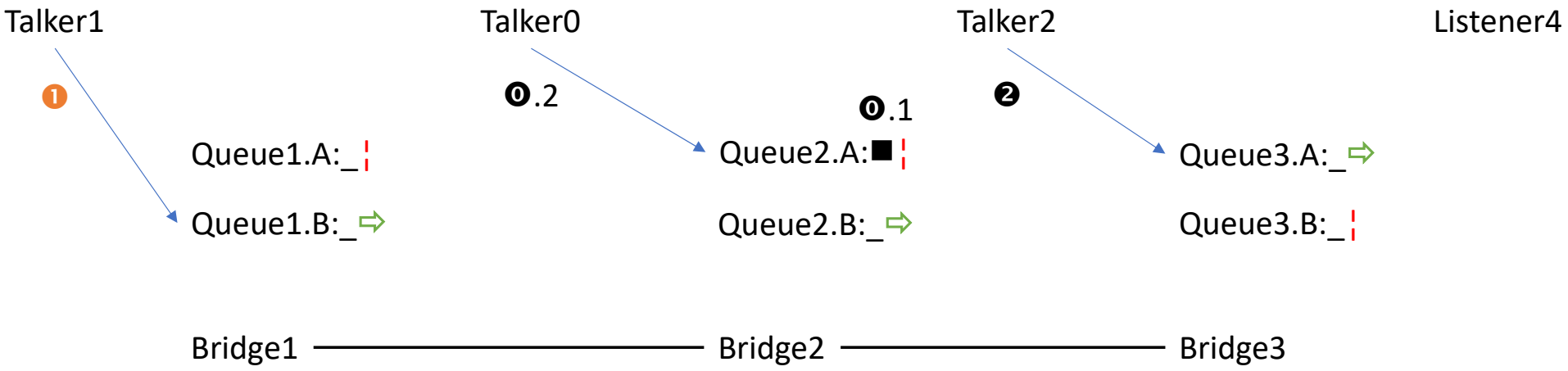
Phased-Mode TDMA enabled TimeIndex: P000.5

Guard-Band Start on Queue1.A!



Phased-Mode TDMA enabled TimeIndex: P001

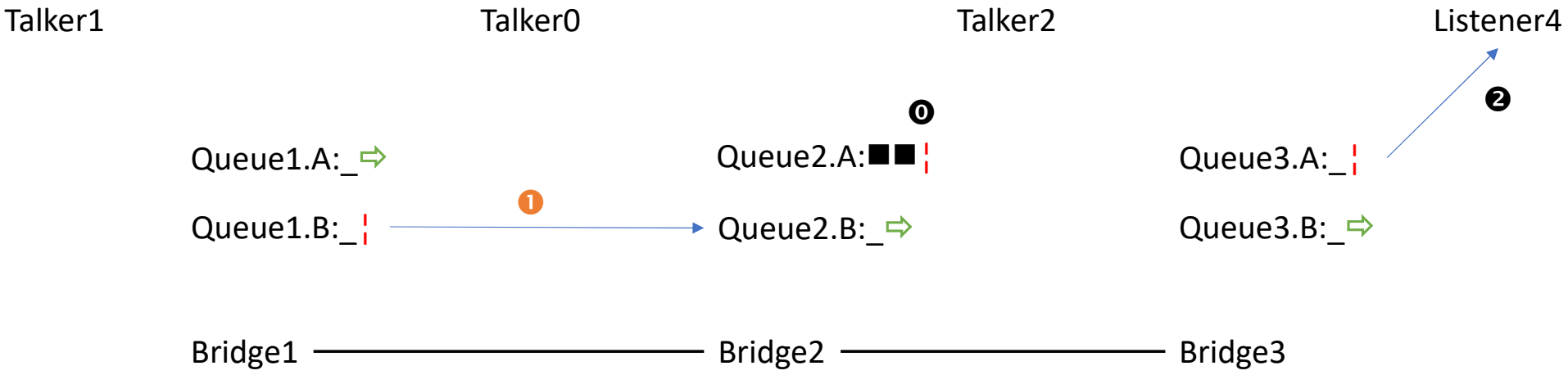
Guard-Band Start on Queue2.A!



4/2

Phased-Mode TDMA enabled TimeIndex: P002

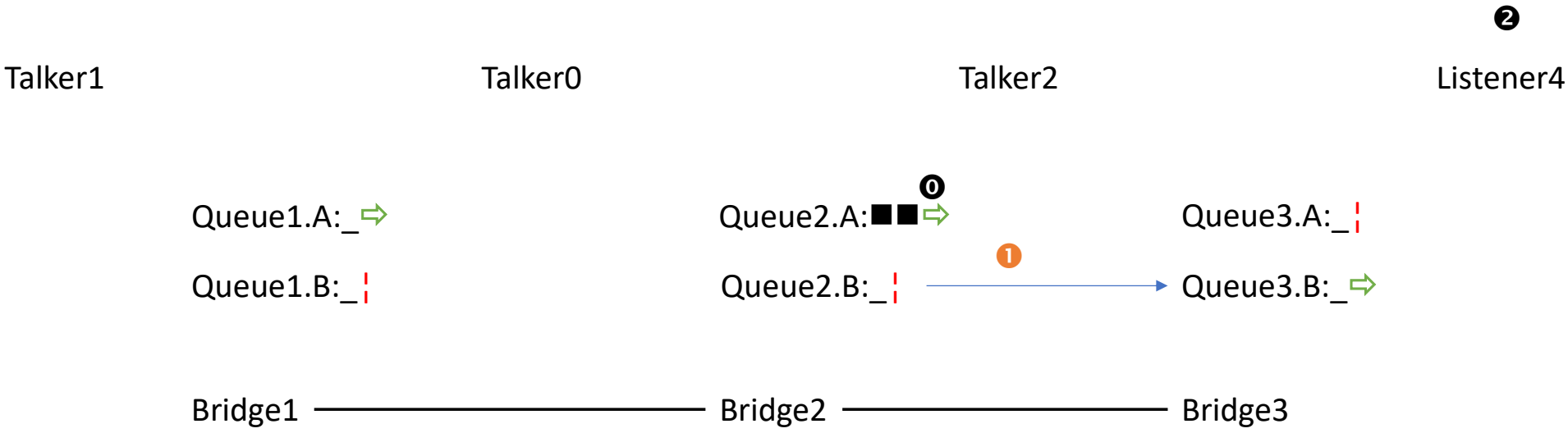
Guard-Band Start on Queue3.A!
Queue1.A can open up after Tolerance-Band!



6/3

Phased-Mode TDMA enabled TimeIndex: P003

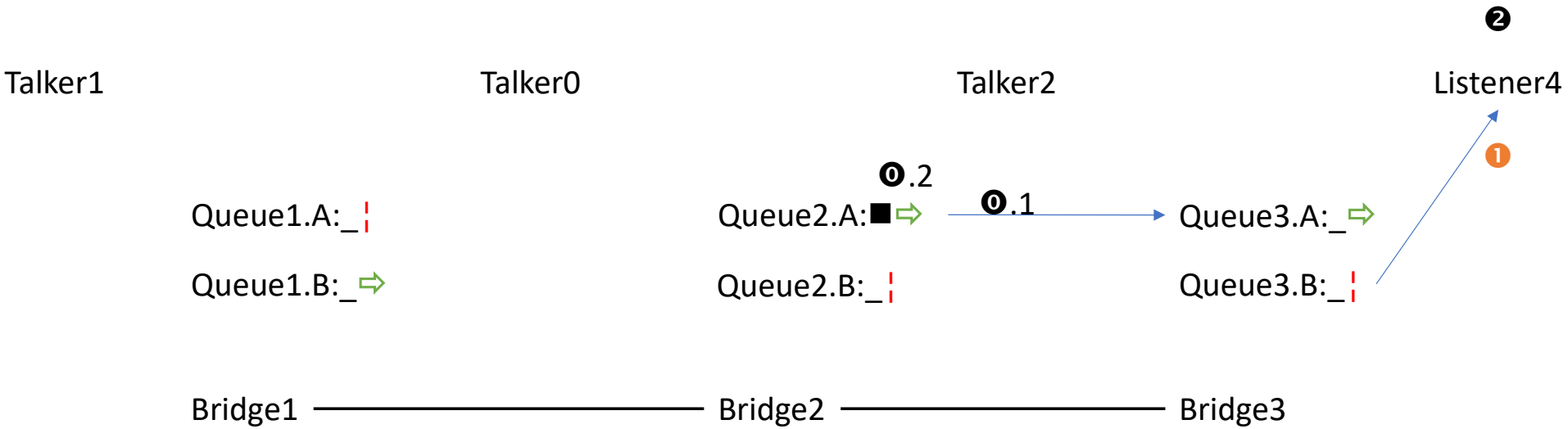
Queue2.A can open up after Tolerance-Band!



7/4

Phased-Mode TDMA enabled TimeIndex: P004

Queue3.A can open up after Tolerance-Band!



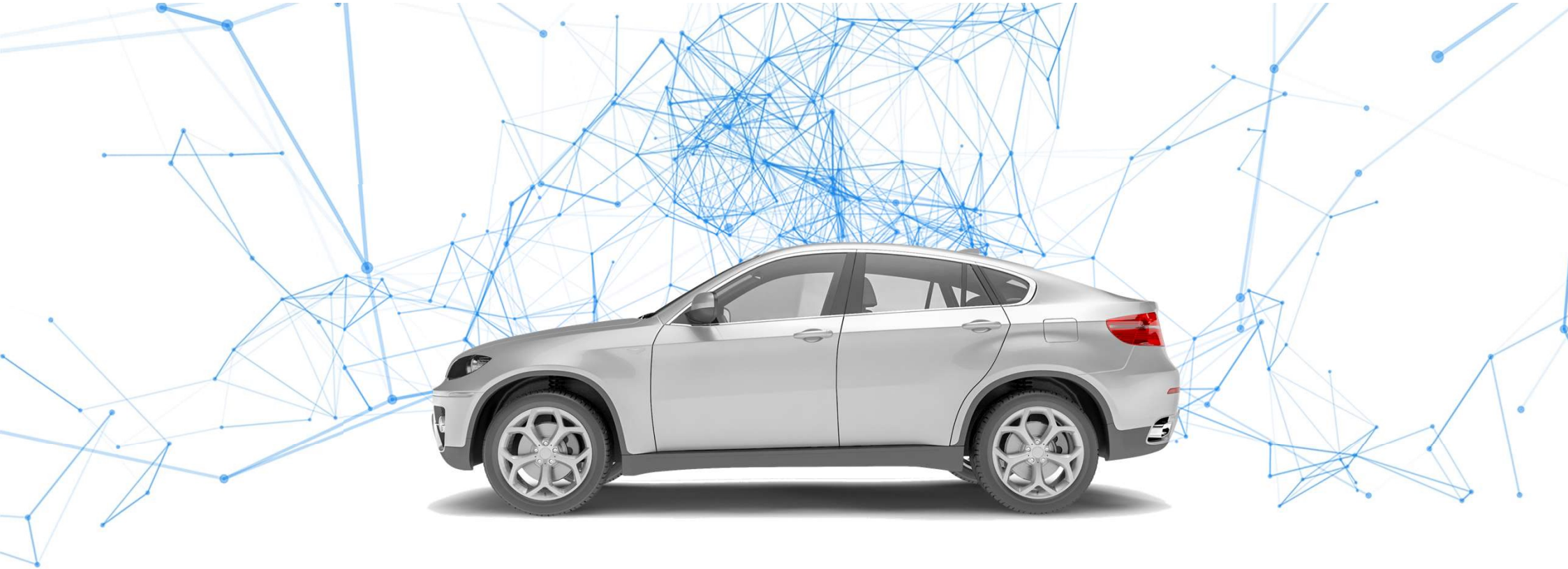
9/5

Conclusions

As the models are very simple, these conclusions are more of an indication than a hard result

Conclusions

- The Bus-Mode TDMA
  - does provide a delivery on time guarantee
  - is rather inefficient on a system wide scale
  - makes Gate-Timing system-wide parameter
  - will suffer from timing inaccuarcy
- The Phased-Mode TDMA
  - does provide a delivery on time guarantee
  - is more efficient on a system wide scale than Bus-Mode
  - makes Gate-Timing a per-hop parameter
  - requires even better timing accuracy than Bus-Mode



THANK YOU

ETHERNOVIA | max.turner@ethernovia.com

ADDITIONAL AFFILIATIONS: BMW, RUETZ SYSTEM SOLUTIONS